NATURAL RESOUCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

IRRIGATION WATER CONVEYANCE

HIGH-PRESSURE, UNDERGROUND, PLASTIC PIPELINE

(Ft.)

CODE 430-DD

DEFINITION

A pipeline and appurtenances installed in an irrigation system.

SCOPE

This standard applies to underground thermoplastic pipeline from 1/2 inch to 27 inches in diameter that are closed to the atmosphere and that are subject to internal pressure of 80-315 pounds per square inch.

The standard includes the design criteria and minimum installation requirements for high-pressure plastic irrigation pipelines and the specifications for the thermoplastic pipe to be used.

PURPOSE

The conservation objectives of this pipeline practice are to prevent erosion or loss of water quality or damage to the land, to make possible the proper management of irrigation water, and to reduce water conveyance losses.

Conditions Where Practice Applies

All pipelines shall be planned and located to serve as an integral part of an irrigation water distribution or conveyance system designed to facilitate the conservation use and management of the soil and water resources on a farm or group of farms.

Water supplies, water quality, and rates of irrigation delivery for the area served by the pipeline shall be sufficient to make irrigation practical for the crops to be grown and the irrigation water application methods to be used.

Plastic pipelines installed according to this standard shall be placed only in suitable soils where the bedding and backfill requirements can be fully met.

DESIGN CRITERIA

A. Working Pressure and Flow Velocity

The minimum acceptable working pressure class shall be pipe having a working pressure rating for water of 80 psi.

The pipeline shall be designed to meet all service requirements without an operating or static pressure at any point greater than the pressure rating of the pipe used at that point. As a safety factor against surge or water hammer, the working pressure should not exceed 72 percent of the pressure rating of the pipe; and the design flow velocity at system capacity shall not be greater than 5 feet per second. When either of these limits is exceeded, special consideration must be given to the flow conditions and measures to adequately protect the pipeline against surge.

B. Capacity

The design capacity of the pipeline shall be based on whichever of the following criteria is the greater:

1. The capacity shall be sufficient to deliver the volume of water required to meet the peak-period consumptive use of the crop or crops to be irrigated.

2. The capacity shall be sufficient to provide an adequate irrigation stream for all methods of irrigation planned.

C. Friction Losses

For design purposes, friction head losses shall be no less than those computed by the Hazen-Williams equation using a roughness coefficient, c, equal to 150.

D. Outlets

Such appurtenances are required to deliver water from the pipeline to an individual sprinkler or to a lateral line of sprinklers or surface pipe located on the ground surface shall be known as outlets. Outlets shall have adequate capacity to deliver the design flow to the individual sprinkler, surface lateral line of sprinklers, or surface pipe at the design operating pressure.

E. Check Valves

A check valve shall be installed between the pump discharge and the pipeline where backflow may occur.

F. Pressure Relief Valves

A pressure relief valve shall be installed between the pump discharge and the pipeline when excessive pressures can be developed by operating with all valves closed. Pressure relief valves shall be installed on the discharge side of the check valve where a reversal of flow may occur and at the end of the pipeline when needed to relieve surge at the end of the line.

Pressure relief valves shall be no smaller than 1/4-inch nominal size for each diameter inch of the pipeline and shall be set to open at a pressure no greater than 5 psi above the pressure rating of the pipeline.

G. Air Release Valves

Three basic types of air release valves available for use on irrigation pipelines are commonly referred to as follows:

1. Air release valve is a continuous acting valve, which has a small venting orifice generally, varying between 1/16” and 3/8” in size. Purpose of this type valve is to release pockets of air from the pipeline once the line is filled and under working pressure.
2. Air and vacuum valve, which has a large venting orifice, exhausts large quantities of air from the pipeline when filling and allows air to reenter the line and prevents a vacuum from forming when emptying. This type valve is sometimes called air-vacuum release valve or air vent and vacuum relief valve. It is not continuous acting since it will not allow further escape of air at working pressure once the valve closes.
3. Combination air valve, sometimes called combination air release and air-vacuum valve or combination air and vacuum relief valve, is continuous acting and combines the functions of both the air release valve and the air and vacuum valve discussed above. Actually, both valves are housed in one valve body.

   When needed to provide positive means for air escape during filling and air entry while emptying, air and vacuum valves or combination air valves shall be installed at all summits, at the entrance, and at the end(s) of the pipeline. Such valves normally are needed at these locations if the line is truly closed to the atmosphere. However, they may not be needed when other features of the pipe system such as permanently located sprinkler nozzles or other unclosed service outlets will adequately vent the particular location during filling and emptying of the line.

   The large orifice (opening which controls air flow during filling and emptying) of an air and vacuum valve or a combination air valve shall be at least 1/2 inch in diameter for pipelines of 5-inch diameter or less, at least 1 inch for pipelines of 6- to 10-inch diameter, and no smaller than 1 3/4 inches for pipelines for 12- to 18-inch diameter.

   Air release valves or combination air valves shall be used as needed to permit air to escape from the pipeline while the line is at working pressure. Small orifices of these types of valves shall be sized based on the working pressure and venting requirements

in accordance with valve manufacturer's recommendations.

H. Draining Requirements

Provisions shall be made for draining the pipeline completely where a hazard is imposed by freezing temperatures, drainage is recommended by the manufacturer of the pipe, or drainage of the line is specified for the job for any reason. Where provisions for drainage are required, drainage outlets shall be located at all low places in the line. These outlets may drain into dry wells or to points of lower elevation. If drainage cannot be thus provided by gravity, provisions shall be made to empty the line by pumping or other means.

I. Flushing Requirements

Where provisions are needed to flush the line free of sediment or other foreign material, a suitable valve shall be installed at the far end of the pipeline.

J. Thrust Control

Anchors or thrust blocks shall be provided on pipelines with working pressures of 25 psi or greater at abrupt changes in pipeline grade, changes in horizontal alignment or reduction in pipe size to absorb any axial thrust of the pipeline. Thrust blocks may also be needed at the end of the pipeline and at in-line control valves.

An abrupt change shall be considered to be: (a) an angle of 45 degrees or greater when the maximum working head is under 10 feet; (b) an angle of 30 degrees or greater when the maximum working head is between 10 and 20 feet; and (c) an angle of 15 degrees or greater when the maximum working head is greater than 20 feet.

Pipe manufacturer's recommendations for thrust control shall be followed. In the absence of the pipe manufacturer's requirements, the following formula should be used in designing thrust blocks:

$$A = \frac{98\ HD^2}{B} \sin \frac{a}{2}$$

Where A = Bearing Area of thrust block required
H = Maximum working pressure in feet
D = Inside diameter of pipe in feet
B = Allowable passive pressure of the soil in lbs. per sq. ft.
a = Deflection angle of pipe bend

Area of thrust blocks for dead ends and tees shall be 0.7 times the area of block required for a 90-deflection angle of pipe bend.

Where adequate soil tests are not available, the passive soil pressure may be estimated from the following table:

Sound Shale	10,000 lb/ft^2
Cemented Gravel and Sand difficult to pick	3,000 lb/ft^2
Coarse and fine compact Sand	2,100 lb/ft^2
Medium Clay – can be spaded	1,000 lb/ft^2
Soft Clay	500 lb/ft^2
Muck	0 lb/ft^2

K. Materials

All materials shall meet or exceed the minimum requirements of this standard under Engineering Specifications for Materials.

PLANS AND SPECIFICATIONS

Plans and specifications for construction of High Pressure Underground Plastic Pipelines shall be in keeping with the standard and shall describe the requirements for application of the practice to achieve its intended purposes.